# Congruent Figures

**Reporting Category**  Geometry

**Topic**  Investigating congruence of plane figures after geometric transformations

**Primary SOL**  4.11  The student will

     a)  investigate congruence of plane figures after geometric transformations, such as reflection, translation, and rotation, using mirrors, paper folding, and tracing; and

     b)  recognize the images of figures resulting from geometric transformations, such as translation, reflection, and rotation.

**Materials**
- Templates of rectangles of various sizes
- Scraps of paper
- Scissors
- Congruent Figures handout (attached)
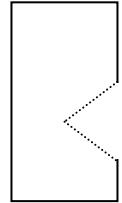- Patty (tracing) paper
- Scraps of cardstock

**Vocabulary**

*plane figures, congruent (congruency), noncongruent, translation, reflection, rotation, geometric transformation*

**Student/Teacher Actions (what students and teachers should be doing to facilitate learning)**

1.  Give each student a set of rectangular templates of various sizes. Instruct students to select one of their templates and use it to trace a rectangle. Next, ask them move the template to another location on the sheet, turn it a different way, and trace another rectangle. Now, ask them to select a smaller or larger template and use it to trace a third rectangle. Then, ask students to describe the three rectangles they drew. This discussion should lead to reviewing, using, and understanding the words *shape, size, congruent,* and *noncongruent*.

2.  Ask students to take a new sheet of paper and trace at the top of the sheet the first rectangular template they used. Have them trace another congruent rectangle below it after turning or flipping the template to make it difficult to tell whether the two rectangles are really congruent. Next, have students trace some more congruent rectangles and some noncongruent rectangles around the sheet, positioning them in different ways. When they are done, have them trade papers. Give students a minute to guess which figures are congruent to the one at the top of the sheet. After students have guessed, distribute pieces of patty paper, and have them trace on the patty paper the original rectangle located at the top. Direct them to use this tracing to identify the other rectangles that are exactly the same (congruent), turning or flipping the patty paper as needed. Have students circle the rectangles that are congruent to the one at the top.

3. Distribute copies of the Congruent Figures handout and additional patty paper, if needed. Have students use the patty paper to help them identify which figures are congruent to those shown in the left-hand column.

4. Distribute scissors and scraps of cardstock. Have each student cut a roughly two-by-three-inch rectangle (only a rough approximation—no need to measure) out of the scrap cardstock. Have them prove it is a rectangle—i.e., that it has four right angles and its opposite sides are of equal length. Then, have them cut a small notch or triangle out of the rectangle, as shown at right. Direct students to use their notched rectangle as a template, as follows:
   - Trace the template, including the notch, on a sheet of paper. Label this rectangle "original."
   - Place the template back in its first position on top of the tracing, slide it slowly in any direction without turning it from its original orientation, and trace it in a second location on the sheet. Label this rectangle "translation (slide)."
   - Turn the template on one point, and trace it in a third location. Label this rectangle "rotation (turn)."
   - Flip the template over, and trace it in a fourth location. Label this rectangle "reflection (flip)."

    original          translation          rotation          reflection
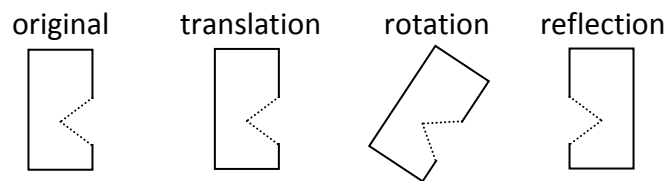
5. After you have talked about these terms, have students go back to the Congruent Figures handout. For each figure they identified as congruent, have them label whether it is a *translation, rotation,* or *reflection*.

**Assessment**
- **Questions**
  - How many sides and angles do the shapes have?
  - How can you tell that the shapes are the same size?
  - How do you know these are the same shape?
  - What does it mean for a figure to be translated, rotated, or reflected?
- **Journal/Writing Prompts**
  - Identify two objects in the classroom or in the school that you believe are congruent. Justify your answer. Describe any geometric transformations of those objects you can find.
  - Look at a picture that shows shapes that are congruent and that have been geometrically transformed. Identify the shapes, and sort them as translations, rotations, or reflections.
- **Other**
  - Provide students with various different figures, and have them generate geometric transformations of each figure. Students could draw/trace the figures onto cards and create a game out of the transformed figures.

**Extensions and Connections (for all students)**
- Invite a guest speaker to speak about geometric shapes and patterns and how they are used in his or her specialty area. Speakers could include an interior designer, a landscape architect, and an artist.
- Ask students to create tessellations, using translation, rotation, and reflection.
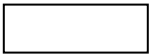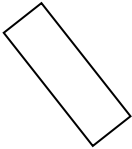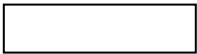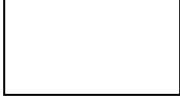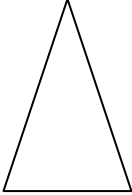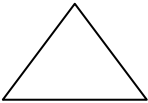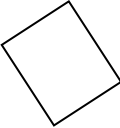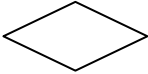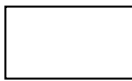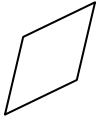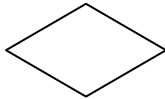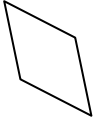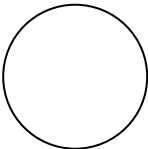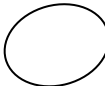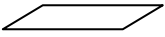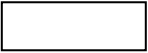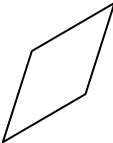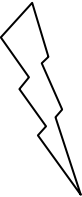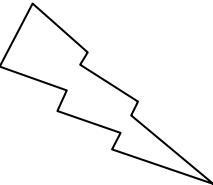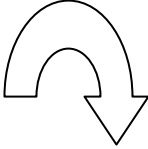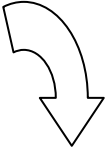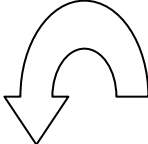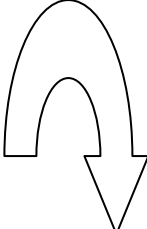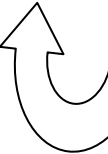
**Strategies for Differentiation**
- Have students search virtual manipulatives online that offer them the opportunity to create and then translate, rotate, and reflect two-dimensional geometric figures.
- Have students create and display a color-coded poster related to the vocabulary and concepts presented in this lesson.
- Enlarge the Congruent Figures handout, as needed.
- Cut the Congruent Figures handout into strips to isolate each set of shapes. Provide a student with one set of shapes at a time.
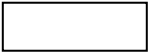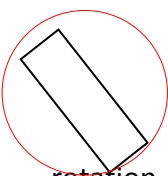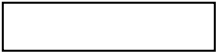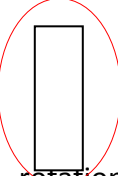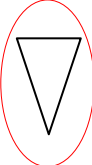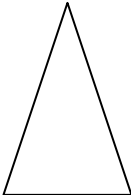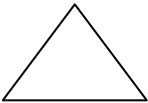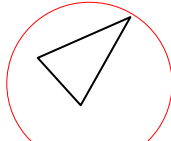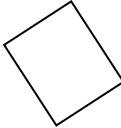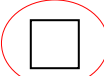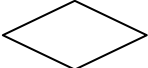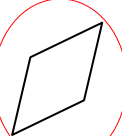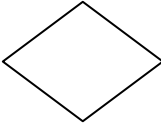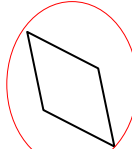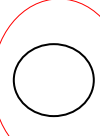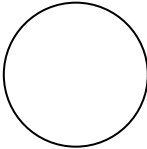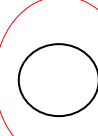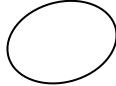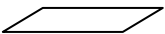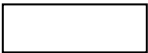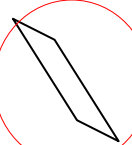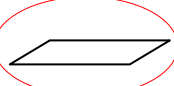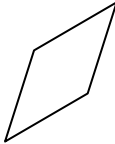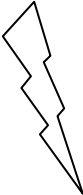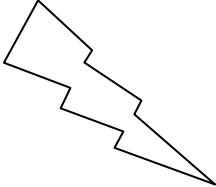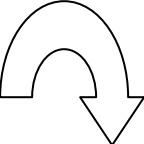
# Congruent Figures

**Name** _____ **Date** _____

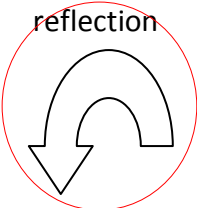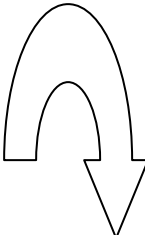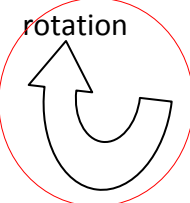Directions: Look carefully at each figure in each row. Circle the figure(s) in that row that are congruent to the first figure in the row. Label each circled figure as a translation, rotation, or reflection.

# Congruent Figures Answer Key

1. rotation    rotation

2. rotation or reflection    rotation

3. rotation    translation

4. rotation    rotation

5. translation    translation

6. rotation    translation

7. reflection    rotation    rotation

8. reflection    rotation